IN THE CLAIMS

This listing of the claim will replace all prior versions and listings of claim in the present application.

Listing of Claims

1. (currently amended)A disk array system comprising:

at least one ATA magnetic disk;

at least one disk array controller for controlling the ATA magnetic disk; and

at least one interface card having a processing offload function module, existing on a path between the disk array controller and the ATA magnetic disk,

wherein the disk array controller outputs to the interface card one of a standard processing FC command for performing a standard processing, and an offload processing FC command for performing a vendor-unique offload processing,

wherein the processing offload function module includes a command analysis processing section, an operation processing section, a data buffer, an ATA connection interface, an ATA command mapping table, and a disk ID information management table which records relationships between FC IDs and ATA connection interface numbers for managing correlation between the FC IDs and the corresponding ATA magnetic disk and thus realizing indirect allocation of the FC IDs,

wherein, when the processing offload function module receives the standard processing FC command sent from the disk array controller, the command analysis processing section determines whether the standard

processing FC command can be mapped onto an ATA command, and if the standard processing FC command can be mapped onto an ATA command, the command analysis processing section uses ~~a~~ the ATA command mapping table to ~~issue to the ATA magnetic disk an~~ select the ATA command that corresponds to the standard processing FC command, prepares in the data buffer the ATA command selected thereby, the ATA connection interface number than can be obtained through correlation with the FC ID from the disk ID information management table and if necessary a storage number for storing data that is obtained by executing the ATA command, and issues the ATA command to the ATA magnetic disk via the ATA connection interface with the ATA connection interface number designated in the data buffer, and

wherein, when the processing offload function module receives the offload processing FC command sent from the disk array controller, the operation processing section takes over the offload processing FC command from the command analysis processing section and prepares a group of ATA commands for the offload processing FC command which achieve an optimal offload processing in an ATA protocol, and computes when necessary.

Claims 2 and 3 (canceled).

4. (currently amended)A disk array system according to claim ~~3~~1, wherein the disk array controller includes an offload processing discrimination section for discriminating whether the processing offload function module is present within the disk array system and if there is a usable offload processing.

5. (currently amended)A disk array system according to claim ~~3~~1, wherein, when the offload processing FC command is a write with parity computation for writing a new data in the ATA magnetic disk, the disk array controller refers to a disk information management table including at least one processing offload function provided by the processing offload function module and indicating which processing offload function can be used on each of the ATA magnetic disk, discriminates whether the ATA magnetic disks of data write destinations can execute the write with parity computation, and if the ATA magnetic disks are found to be able to execute the write with parity computation, issues a vendor-unique offload command for instructing the write with parity computation to one of the ATA magnetic disks that is the write data destination, and the processing offload function module receives the vendor-unique offload command in place of the ATA magnetic disk, and~~,~~ the operation processing section of the processing offload function module issues an ATA ~~a~~ read command to read an old data and old parity from the ATA magnetic disk, executes ~~a parity~~ computation of a new parity, and issues a write command to write the new data and new parity in the ATA magnetic disk.

6. (currently amended)A disk array system according to claim ~~3~~1, wherein, when the offload processing FC command is an online multiple disk verification, the disk array controller issues a vendor-unique offload command for executing the online multiple disk verification, which contains a command identification number and a list of IDs of the ATA magnetic disks that are

targets of simultaneous execution, to a representative disk that is one of the ATA magnetic disks assigned IDs on the list, and the processing offload function module receives the vendor-unique offload command in place of the representative disk, and the operation processing section of the processing offload function module takes over the offload processing FC command from the command analysis processing section, and issues a read command simultaneously to a plurality of the ATA magnetic disks corresponding to IDs provided in ~~a~~ the list ~~by the disk array controller~~.

7. (currently amended)A processing offload function module in an interface card existing on a path between at least one ATA magnetic disk and a disk array controller that controls the ATA magnetic disk, the processing offload function module comprising:

a section that receives from the disk array controller one of a standard processing FC command for performing a standard processing, and an offload processing FC command for performing a vendor-unique offload processing; ~~and~~

a ATA connection interface that sends an ATA command to the ATA magnetic disk;

a disk ID information management table that records relationship between FC IDs and ATA connection interface numbers for managing correlation between the FC IDs and the corresponding ATA magnetic and thus realizing indirect allocation of the FC IDs;

a section that, when a FC command from the disk array controller is the standard processing FC command, determines whether the standard

processing FC command can be mapped onto an ATA command, and if the standard processing FC command can be mapped on an ATA command, uses ~~a~~ an ATA command mapping table to ~~issue to the ATA magnetic disk an~~ select the ATA command that corresponds to the standard processing FC command, prepares the ATA command selected thereby, the ATA connection interface number that can be obtained from a disk ID information management table and if necessary a storage number for storing data that is obtained by executing the ATA command, and issues the ATA command to the ATA magnetic disk via the ATA connection interface with the ATA connection interface number; and

a section that, when a FC command from the disk array controller is the offload processing FC command, takes over the offload processing FC command from the command analysis processing section and and prepares a group of ATA commands for the offload processing FC command which achieve an optimal offload processing in an ATA protocol, and computes when necessary.

Claim 8 (canceled).

9. (currently amended)A processing offload function module according to claim ~~8~~7, wherein the offload processing FC command is one of a write command with parity computation, an online multiple disk verification command, a RAID format command, and an inter-disk copy command.

10. (currently amended)A disk array system including a plurality of ATA magnetic disks, at least one disk array controller for controlling the ATA magnetic disks, and at least one interface card existing on a path between the disk array controller and the ATA magnetic disks, the disk array system comprising:

at least one disk storage housing containing a processing offload function module that connects to the ATA magnetic disks,

wherein the disk array controller outputs to the interface card one of a standard processing FC command for performing a standard processing, and an offload processing FC command for performing a vendor-unique offload processing, ~~and~~

wherein the processing offload function module includes a command analysis processing section, an operation processing section, a data buffer, an ATA connection interface, an ATA command mapping table, and a disk ID information management table which records relationship between FC IDs and ATA connection interface numbers for managing correlation between the FC IDs and the corresponding ATA magnetic and thus realizing indirect allocation of the FC IDs,

wherein, when the processing offload function module receives the standard processing FC command sent from the disk array controller, the command analysis processing section determines whether the standard processing FC command can be mapped onto an ATA command, and if the standard processing FC command can be mapped onto an ATA command, the command analysis processing section uses ~~a~~ the ATA command mapping table to ~~issue to the ATA magnetic disk an~~select the ATA command

that corresponds to the standard processing FC command, prepares in the data buffer the ATA command selected thereby, the ATA connection interface number that can be obtained through correlation with the FC ID from the disk ID information management table and if necessary a storage number for storing data that is obtained by executing the ATA command, and issues the ATA command to the ATA magnetic disk via the ATA connection interface with the ATA connection interface number designated in the data buffer, and

wherein, when the processing offload function module receives the offload processing FC command sent from the disk array controller, the operation processing section takes over the offload processing FC command from the command analysis processing section and prepares a group of ATA commands for the offload processing FC command which achieve an optimal offload processing in an ATA protocol, and computes when necessary.

Claims 11 and 12 (canceled).

13. (currently amended)A disk array system according to claim ~~12~~10, wherein the offload processing FC command is one of a write command with parity computation, an online multiple disk verification command, a RAID format command, and an inter-disk copy command.

14. (currently amended)A disk array system comprising a plurality of magnetic disks, at least one disk array controller for controlling the magnetic disks, and at least one interface card having a processing offload function

module existing on a path between the disk array controller and the magnetic disks,

wherein the plurality of magnetic disks include at least one ATA magnetic disk and at least one FC magnetic disk mixed therein,

wherein the disk array controller outputs to the interface card one of a standard processing FC command for performing a standard processing, and an offload processing FC command for performing a vendor-unique offload processing, ~~and~~

wherein the processing offload function module includes a command analysis processing section, an operation processing section, a data buffer, an ATA connection interface, an ATA command mapping table, and a disk ID information management table which records relationship between FC IDs and ATA connection interface numbers for managing correlation between the FC IDs and the corresponding ATA magnetic and thus realizing indirect allocation of the FC IDs,

wherein, when a FC command from the disk array controller is the standard processing FC command and is to access the FC magnetic disk, the processing offload function module passes the standard processing FC command to the FC magnetic disk without any processing rendered thereon, and

wherein, when a FC command from the disk array controller is the standard processing FC command and is to access the ATA magnetic disk, the command analysis processing section of the processing offload function module determines whether the standard processing FC command sent from the disk array controller can be mapped onto an ATA command onto an ATA

command, and if the standard processing FC command can be mapped, the command analysis processing section uses ~~a~~ the ATA command mapping table to issue to the ATA magnetic disk an ATA command that corresponds to the standard processing FC command, prepares in the data buffer the ATA command selected thereby, the ATA connection interface number that can be obtained through correlation with the FC ID from the disk ID information management table and if necessary a storage number for storing data that is obtained by executing the ATA command, and issues the ATA command to the ATA magnetic disk via the ATA connection interface with the ATA connection interface number designated in the data buffer, and

wherein, when a FC command from the disk array controller is the offload processing FC command, the operation processing section of the processing offload function module takes over the offload processing FC command from the command analysis processing section and converts the FC command into a group of commands that achieve optimum operation according to the type of the magnetic disks to be accessed and processing contents.

Claims 15-17 (canceled).

18. (currently amended)A disk array system according to claim ~~17~~14, wherein the offload processing FC command is one of a write command with parity computation, an online multiple disk verification command, a RAID format command, and an inter-disk copy command.

19. (currently amended)A disk array system comprising a plurality of magnetic disks, at least one disk array controller for controlling the magnetic disks, and at least one interface card existing on a path between the disk array controller and the magnetic disks,

wherein the plurality of magnetic disks include at least one ATA magnetic disk and at least one FC magnetic disk mixed therein,

wherein the disk array controller includes a controller processing section that is connected to a processing offload function module provided for the disk array controller,

wherein the controller processing section outputs to the processing offload function module one of a standard processing FC command for performing a standard processing, and an offload processing FC command for performing a vendor-unique offload processing,

wherein, when a FC command from the disk array controller is the standard processing FC command and is to access the FC magnetic disk, the processing offload function module passes the standard processing FC command via the interface card to the FC magnetic disk without any processing rendered thereon, ~~and~~

wherein the processing offload function module includes a command analysis processing section, an operation processing section, a data buffer, an ATA connection interface, an ATA command mapping table,

wherein, when a FC command from the disk array controller is the standard processing FC command and is to access the ATA magnetic disk, the command analysis processing section of the processing offload function module determines whether the standard processing FC command can be

mapped onto an ATA command, and if the standard processing section uses ~~a~~ the ATA command mapping table to ~~issue via the interface card to the ATA magnetic disk an~~select the ATA command that corresponds to the standard processing FC command, prepares in the data buffer the ATA command selected thereby and if necessary a storage number for storing data that is obtained by executing the ATA command, and issues the ATA command via the interface card to the ATA magnetic disk, and

wherein, when a FC command from the disk array controller is the offload processing FC command, the operation processing section of the processing offload function module takes over the offload processing FC command from the command analysis processing section and converts the FC command into a group of commands that achieve optimum operation according to the type of the magnetic disks to be accessed and processing contents.

20. (original) A disk array system according to claim 19, wherein, when a FC command from the disk array controller is the offload processing FC command, the processing offload function module converts the offload processing FC command into a group of commands that achieve optimum operation according to the type of the magnetic disks to be accessed and processing contents.